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(54) **METHOD AND SYSTEM FOR IMPROVED CURTAIN WALL SEALING**

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(52) **U.S. Cl.**
CPC .. ***E04B 2/965*** (2013.01); ***E04B 2/96*** (2013.01)

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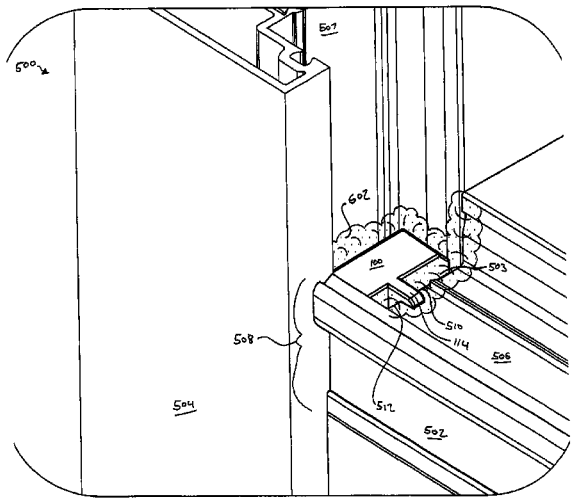
(57) **ABSTRACT**

In one aspect, the present invention relates to a plug of the type utilized for sealing a junction between a horizontal member and a vertical mullion of a curtain wall. The plug may include a plug body. The plug body may include a front body portion, a rear body portion, a left body portion, a right body portion, a top surface disposed between the left body portion, the right body portion, the front body portion, and the rear body portion. A rabbet is disposed across the front body portion. A spacer flange extends from the front body portion. A plurality of chamfers are disposed between the top surface and the left body portion, the right body portion, and the rear body portions. The plug is sized to occupy a gap formed in the junction between the horizontal member and the vertical mullion of the curtain wall. The rabbet and the plurality of chamfers form a plurality of large crevices between the plug, the horizontal member, and the vertical mullion. The large crevices allow penetration of a sealant therein.

11 Claims, 5 Drawing Sheets



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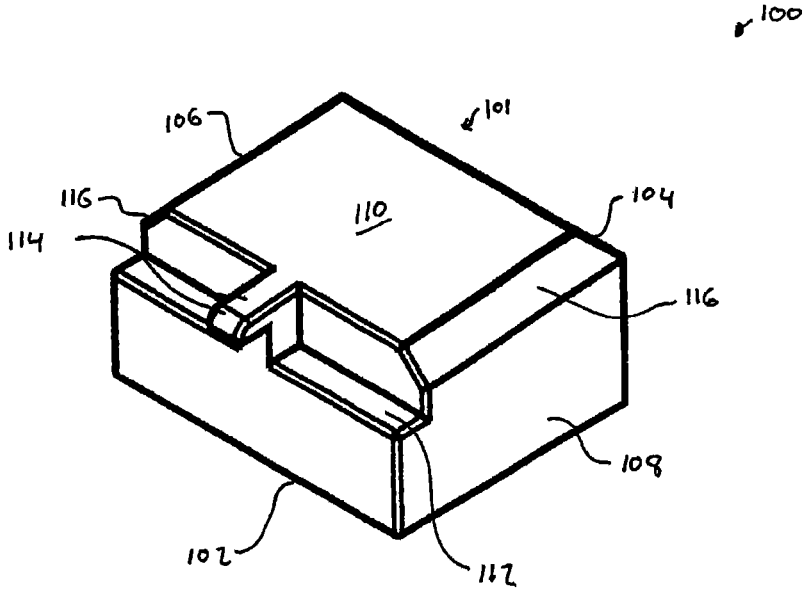


Figure 1

Fig. 2

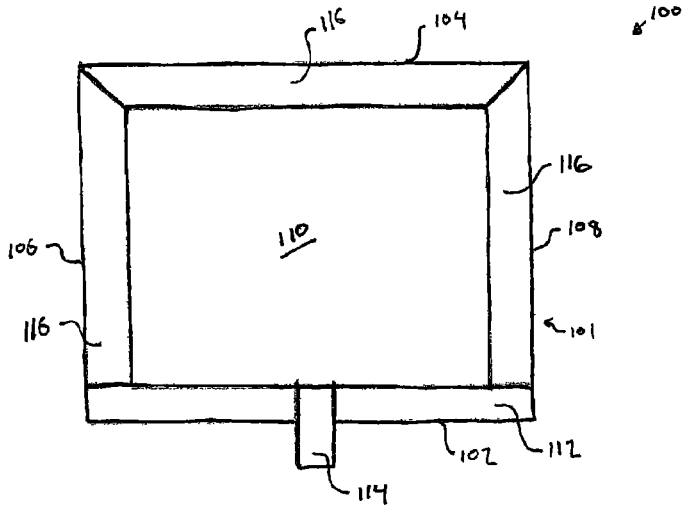


Fig. 3

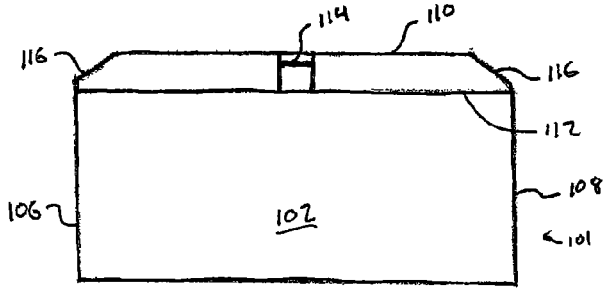
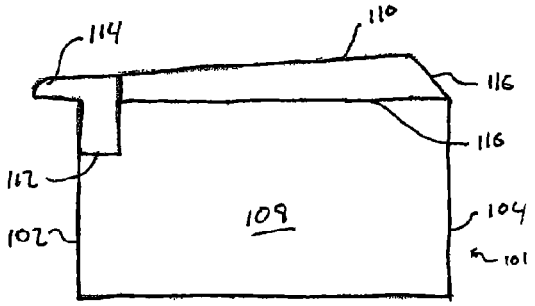


Fig. 4



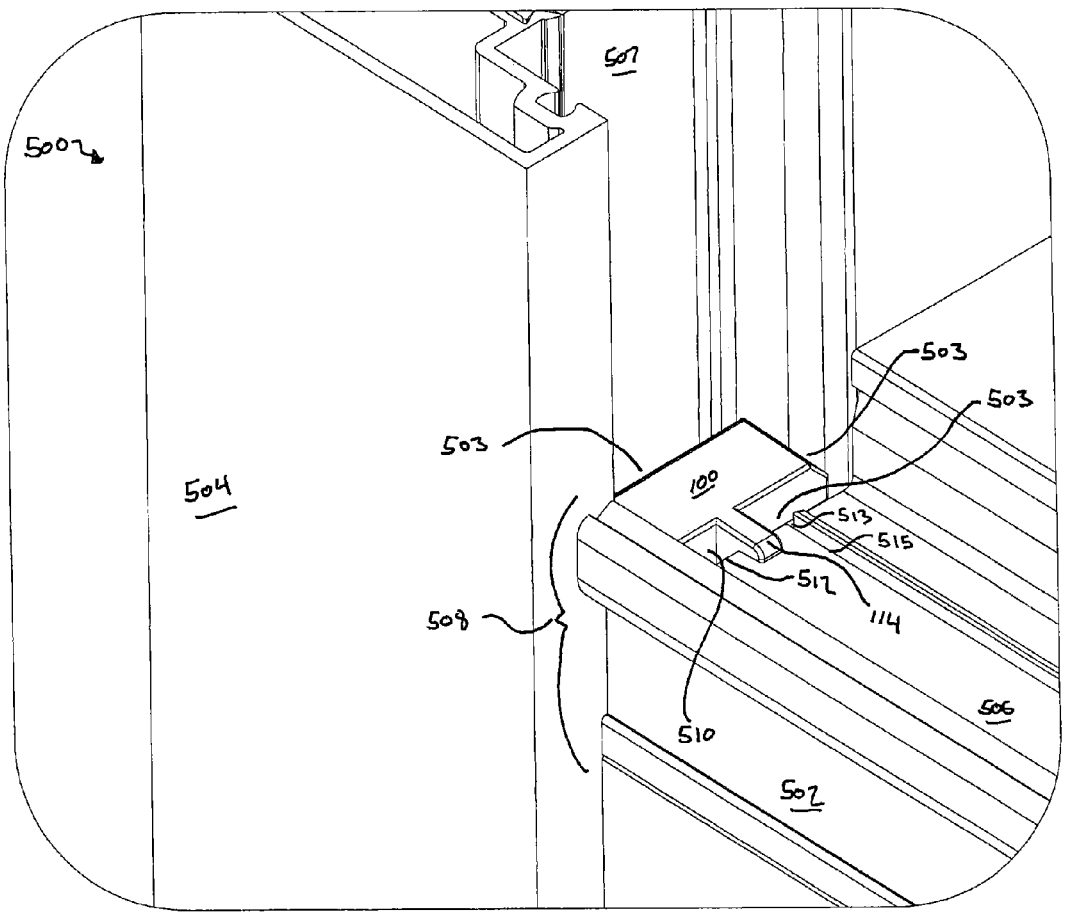


Figure 5

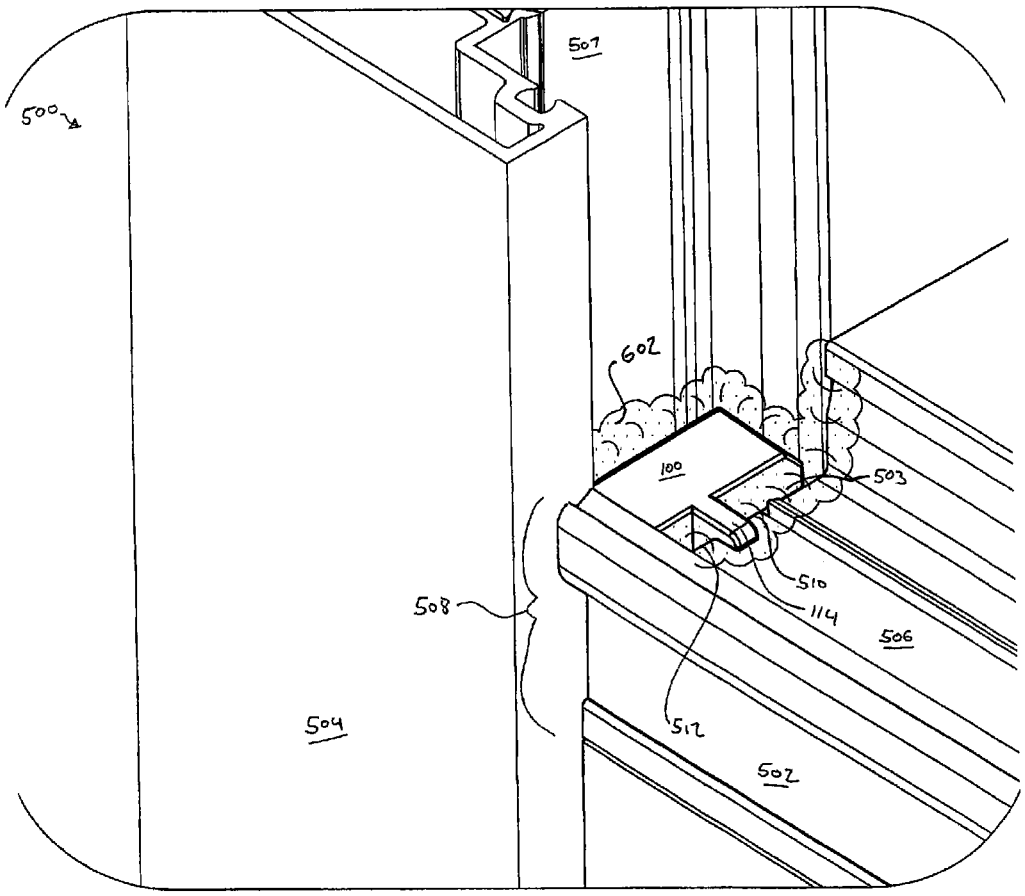


Figure 6

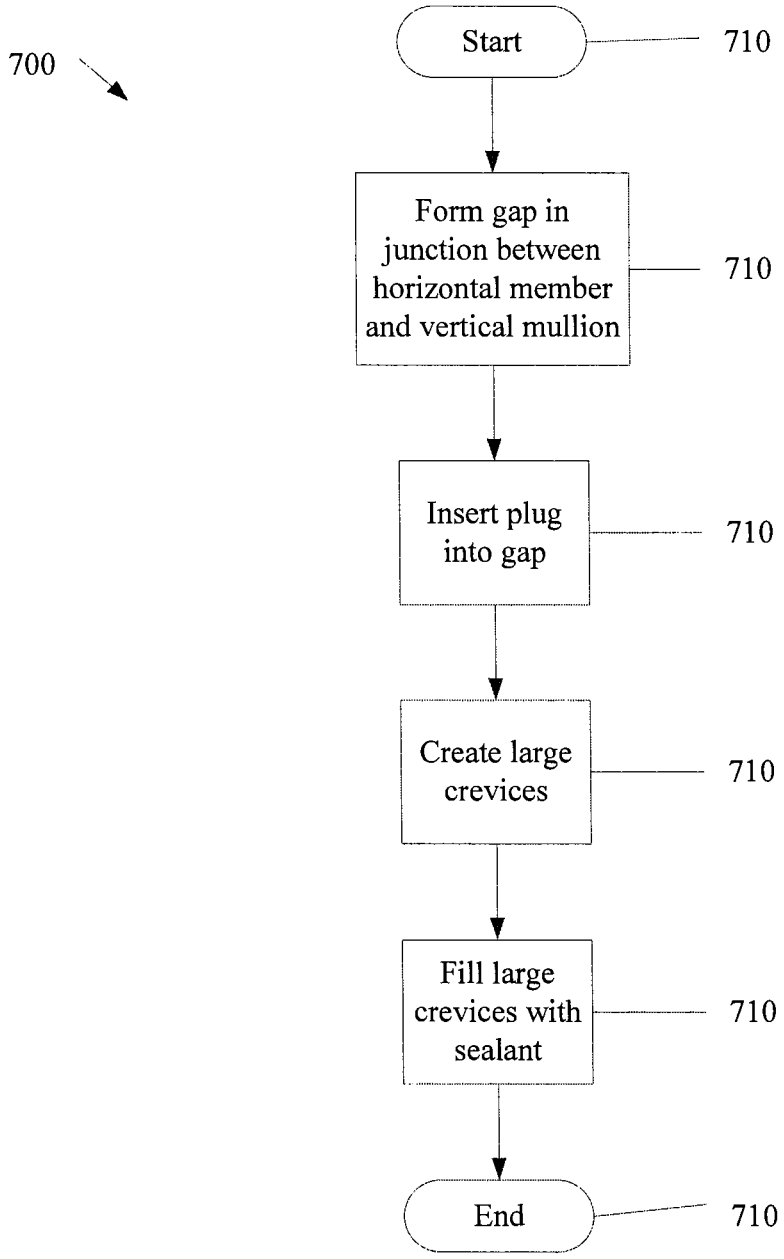

700
Start
710
Form gap in junction between horizontal member and vertical mullion
710
Insert plug into gap
710
Create large crevices
710
Fill large crevices with sealant
710
End
710

FIGURE 7

METHOD AND SYSTEM FOR IMPROVED CURTAIN WALL SEALING

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to, and incorporates by reference the entire disclosure of, U.S. Provisional Patent Application No. 61/445,935, filed Feb. 23, 2011.

BACKGROUND

1. Field of the Invention

The present application relates to methods and systems for selectively sealing areas of curtain walls and more particularly, but not by way of limitation, to methods and systems for sealing junctions between horizontal and vertical support members of curtain walls during construction.

2. History of the Related Art

Building curtain-wall technology is well known and accepted in the industry. Curtain walls are typically constructed of, for example, extruded aluminum support members having generally U-shaped channels (although other shapes may be utilized) for supporting a plurality of panel members. The plurality of panel members serve as an exterior of a building and are usually panes of glass, and often double-pane glass sections, but other building materials such as, for example, aluminum, granite, slate, or concrete may be utilized. The plurality of panel members are often of identical size and shape. However, near doors, opening windows, and other access points into the building, panel members of different sizes and shapes may be utilized.

Curtain walls generally include a horizontal member intersecting with a vertical mullion at a junction. The junction typically requires cutting of at least a portion of the horizontal member around the vertical mullion. Sealing is often required between a cut portion of the horizontal member and the vertical mullion to prevent infiltration of, for example, water and other contaminants into the junctions. In many curtain-wall systems, a plug is inserted into a gap formed between a cut edge of the horizontal member and the vertical mullion. After insertion of the plug, the edges of the plug are sealed with a sealant such as, for example, silicone.

In many instances, edges of the horizontal member, the vertical mullion, and the plug are not precisely square due to, for example, human error or manufacturing limitations. These imperfections cause crevices to be present within the junctions. Furthermore, profile contours associated with the horizontal member, the vertical member, and the plug also create crevices. These crevices are often quite small and, in many cases, are nearly imperceptible to the human eye. Such crevices may, however, be sufficient to permit infiltration of water into the curtain-wall system. In addition, the crevices often make accurate placement of sealant difficult and time consuming due to an inability of a worker to see the crevices. Larger crevices are often more visible to a worker and, thus, more effectively sealed. Furthermore, larger crevices permit better infiltration of sealant thereby creating a better seal.

SUMMARY

In one aspect, the present invention relates to a plug of the type utilized for sealing a junction between a horizontal member and a vertical mullion of a curtain wall. The plug may include a plug body. The plug body may include a front body portion, a rear body portion, a left body portion, a right body portion, and a top surface disposed between the left body portion, the right body portion, the front body portion, and the rear body portion. A rabbet is disposed across the front body portion. A spacer flange extends from the front body portion. A plurality of chamfers are disposed between the top surface and the left body portion, the right body portion, and the rear body portion. The plug is sized to occupy a gap formed in the junction between the horizontal member and the vertical mullion of the curtain wall. The rabbet and the plurality of chamfers form a plurality of large crevices between the plug, the horizontal member, and the vertical mullion. The large crevices allow penetration of a sealant therein.

In another aspect, the present invention relates to a method of sealing a junction between a horizontal member and a vertical mullion of a curtain wall. The method may include forming a gap between the horizontal member and the vertical mullion and inserting a plug into the gap. The method may also include creating, via the plug, a plurality of large crevices between the plug, the horizontal member, and the vertical mullion and placing a sealant in the large crevices.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, and for further objects and advantages thereof, reference may now be had to the following description taken in conjunction with the accompanying drawings in which:

FIG. **1** is a perspective view of a plug according to an exemplary embodiment;

FIG. **2** is a top view of a plug according to an exemplary embodiment;

FIG. **3** is a front view of a plug according to an exemplary embodiment;

FIG. **4** is a side view of a plug according to an exemplary embodiment;

FIG. **5** is a perspective view of a curtain-wall junction according to an exemplary embodiment;

FIG. **6** is a perspective view of a curtain-wall junction according to an exemplary embodiment; and

FIG. **7** is a flow diagram of a process for sealing a curtain-wall junction according to an exemplary embodiment.

DETAILED DESCRIPTION

Various embodiments of the present invention will now be described more fully with reference to the accompanying drawings. The invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein.

FIG. **1** is a perspective view of a plug according to an exemplary embodiment. A plug **100** includes a plug body **101**. The plug body **101** includes a front body portion **102** and a rear body portion **104** disposed in a generally parallel relationship relative to each other. Similarly, the plug body **101** includes a left body portion **106** and a right body portion **108** disposed in a generally parallel relationship relative to each other and a generally perpendicular relationship relative to the front body portion **102** and the rear body portion **104**. However, in various alternative embodiments, the front body portion **102**, the rear body portion **104**, the left body portion **106**, and the right body portion **108** may be arranged in any configuration with respect to each other. A top surface **110** is disposed between the front body portion **102**, the rear body portion **104**, the left body portion **106**, and the right body portion **108**. In a typical embodiment, the front body portion **102**, the rear body portion **104**, the left body portion **106**, the

right body portion **108**, and the top surface **110** define a hollow space within the plug body **101**. In alternate embodiments, the plug **100** is solid.

Still referring to FIG. **1**, in a typical embodiment, a rabbet **112** is formed along the front body portion **102**. As used herein, the term "rabbet" refers to a recess or groove cut into an edge of a piece of machineable material. A spacer flange **114** extends in a generally orthogonal orientation from the front body portion **102**. Chamfers **116** are disposed between the top surface **110** and the rear body portion **104**, the left body portion **106**, and the right body portion **108**. As used herein, the term "chamfer" refers to a shallow cut, edge, or groove made in a corner of a machineable material. In a typical embodiment, the plug is constructed from a lightweight machineable material such as, for example, Teflon® or Delrin®, both manufactured and sold by E.I. du Pont de Nemours and Company of Wilmington, Del. In various other embodiments, the plug **100** may be constructed from any other machineable polymeric or metallic materials.

FIG. **2** is a top view of the plug **100** according to an exemplary embodiment. The spacer flange **114** is located approximately centrally between the left body portion **106** and the right body portion **108**. In various alternative embodiments, the spacer flange **114** may be positioned elsewhere on the front body portion **102**; however, as will be discussed further hereinbelow, the spacer flange **114** is located so as not to interfere with placement of sealant. FIG. **2** illustrates the plug **100** as including a single spacer flange **114**; however, in various alternative embodiments, any number of spacer flanges **114** may be utilized depending on design requirements. The rabbet **112** extends substantially across the front body portion **102**. As illustrated in FIGS. **1-2**, in various embodiments, the rabbet **112** is interrupted by the spacer flange **114**; however, in various alternative embodiments, the rabbet **112** may extend entirely across the front body portion **102** without interruption. Such an arrangement provides an uninterrupted The chamfers **116** extend substantially across the left body portion **106**, the right body portion **108**, and the rear body portion **104**.

FIG. **3** is a front view of the plug **100** according to an exemplary embodiment. In a typical embodiment, the chamfers **116** are disposed at an angle of approximately 45 degrees relative to the left body portion **106**, the right body portion **108**, and the rear body portion **104** (shown in FIG. **2**); however, in various alternative embodiments, the chamfers **116** may be formed at any appropriate angle. In a typical embodiment a depth of the rabbet **112** is approximately equal to a depth of the chamfers **116**. However, in various alternative embodiments, the rabbet **112** may be formed shallower or deeper than the chamfers **116**.

FIG. **4** is a side view of a plug according to an exemplary embodiment. The top surface **110** is sloped toward the front body portion **102** thereby directing moisture away from a vertical mullion **504** (shown in FIG. **5**) and onto the horizontal member **502** (shown in FIG. **5**). In various alternative embodiments, the top surface **110** may be flat or any other appropriate shape. As shown in FIGS. **2-4**, the front body portion **102**, the rear body portion **104**, the left body portion **106** (shown in FIG. **1**), and the right body portion **108** intersect each other at approximately right angles. However, in alternative embodiments, the front body portion **102**, the rear body portion **104**, the left body portion **106**, and the right body portion **108** may intersect each other at any angle.

FIG. **5** is a perspective view of a curtain-wall junction according to an exemplary embodiment. A curtain-wall system **500** includes a horizontal member **502** and a vertical mullion **504**. A horizontal thermal barrier **506** and a vertical thermal barrier **507** are disposed within the horizontal member **502** and the vertical mullion **504**, respectively. In various other embodiments, however, the horizontal thermal barrier **506** and the vertical thermal barrier **507** may be omitted. In such embodiments, the horizontal member **502** and the vertical mullion **504** are unitary extrusions of, for example, aluminum. The horizontal member **502** and the vertical mullion **504** intersect at a junction **508**. Within the junction **508**, the horizontal member **502** and the horizontal thermal barrier **506** are cut to accommodate placement of the vertical mullion **504**. A gap **510** is created between a cut edge **512** of the horizontal member **502** and the vertical thermal barrier **507**. Further, in embodiments including the horizontal thermal barrier **506**, small crevices **513** are present near an interface **515** of the horizontal thermal barrier **506** and the horizontal member **502**.

Still referring to FIG. **5**, in various alternative embodiments, the vertical mullion **504** and the vertical thermal barrier **507** are cut to accommodate placement of the horizontal member **502**. For brevity and clarity of discussion, the present invention will be described herein as having the horizontal member **502** cut to accommodate placement of the vertical mullion **504**.

Still referring to FIG. **5**, in a typical embodiment, the plug **100** is inserted into the gap **510** such that the spacer flange **114** engages the cut edge **512** of the horizontal member **502**. In embodiments including the horizontal thermal barrier **506** and the vertical thermal barrier **507**, the spacer flange **114** engages the horizontal thermal barrier **506**. Engagement of the spacer flange **114** with the cut edge **512** of the horizontal member **502** provides an indication of accurate placement of the plug **100** within the gap **510**. In a typical embodiment, the spacer flange **114** ensures that the plug **100** is securely abutted against the both the horizontal member **502** and the vertical mullion **504**. The spacer flange **114** further ensures that the plug **100** is not pulled through the gap **510** through operation of gravity. However, in a typical embodiment, the spacer flange does not interfere, or otherwise overlap, the small crevices **513** present near the interface **515**. Such an arrangement prevents sealing of the small crevices **513**. In a typical embodiment, the gap **510** is sized such that the plug **100** fits snugly therein. The plug **100**, as shown in FIGS. **1-5** is generally rectangular-shaped when viewed from the top. However, one skilled in the art will recognize that, in alternative embodiments, the plug **100** may be any appropriate shape as required. The top surface **110** of the plug **100**, in various embodiments, is shaped to match an interior contour of at least one of the horizontal member **502** or the vertical mullion **504**.

Still referring to FIG. **5**, during operation, the rabbet **112** and the chamfers **116** (shown in FIGS. **1-4**) create large crevices **503** between the plug **100**, the horizontal member **502**, and the vertical mullion **504**. The large crevices **503** provide a visual indicator to a worker of areas requiring sealant. In particular, the rabbet **112** allows ample room for sealant to completely cover the cut edge **512** of the horizontal member **502** thereby sealing the small crevices **513** present near the interface **515**. Many sealants are viscous liquids or amorphous solids. The sealants, thus, are often not able to penetrate into small crevices due to high sealant viscosity. The large crevices **503** provide ample room to allow penetration of sealant. The large crevices **503** allow sealant to adhere to the cut end **512** of the horizontal member **502**

FIG. **6** is a perspective view of a curtain-wall junction according to an exemplary embodiment. Referring to FIGS. **5** and **6**, after placement of the plug **100** within the gap **510**, a sealant **602** such as, for example, silicone or any other indus-

try-applicable sealant, is placed within the large crevices **503**. The sealant **602** infiltrates the large crevices **503** around the plug **100** thereby sealing the junction **508** between the vertical mullion **504** and the horizontal member **502**. In particular, the rabbet **112** (shown in FIG. **1**) allows the sealant **602** to completely envelop the cut edge **512** of the horizontal member **502** thereby sealing the small crevices **513** present near the interface **515** of the horizontal thermal barrier **506** and the horizontal member **502**. Combined use of the plug **100** and the sealant **602** effectively seals the gap **510** between the cut edge **512** of the horizontal member **502** and the vertical mullion **504**.

FIG. **7** is a flow diagram of a process for sealing a curtain wall junction according to an exemplary embodiment. A process **700** starts at step **710**. At step **720**, a junction is formed in a curtain-wall system **500** between a horizontal member **502** and a vertical mullion **504** thereby creating a gap **510**. At step **730**, a plug **100** is inserted into the gap such that a spacer flange **114** engages the cut edge **512** of the horizontal member **502**. At step **740**, large crevices **503** are created as a result of the plug **100** having chamfers **116** and a rabbet **112**. At step **750**, the large crevices are filled with a sealant **602** such as, for example, silicone. The process **700** ends at step **760**. In various embodiments, the horizontal member **502** and the vertical mullion **504** may include the horizontal thermal barrier **506** and the vertical thermal barrier **507** as discussed above with respect to FIGS. **5** and **6**. As discussed above, the process **700** allows accurate placement of a sealant. In addition, the process **700** provides crevices of sufficient size to allow the sealant to penetrate and seal the crevice.

Referring now to FIGS. **1-7**, the rabbet **112** and the chamfers **116** (shown in FIGS. **1-4**) create large crevices **503** between the plug **100**, the horizontal member **502**, and the vertical mullion **504**. The large crevices **503** provide a visual indicator to a worker of areas requiring sealant. Many sealants are viscous liquids or amorphous solids. The sealants, thus, are often not able to penetrate into small crevices due to high sealant viscosity. The large crevices **503** provide ample room to allow penetration of sealant.

Although various embodiments of the method and system of the present invention have been illustrated in the accompanying Drawings and described in the foregoing Specification, it will be understood that the invention is not limited to the embodiments disclosed, but is capable of numerous rearrangements, modifications, and substitutions without departing from the spirit and scope of the invention as set forth herein. It is intended that the Specification and examples be considered as illustrative only.

What is claimed is:

1. A plug for sealing a junction between a horizontal member and a vertical mullion of a curtain wall, the plug comprising:

a plug body comprising:

a front body portion;

a rear body portion;

a left body portion;

a right body portion; and

a top surface disposed between the left body portion, the right body portion, the front body portion, and the rear body portion, the top surface being sloped from the rear body portion downwardly towards the front body portion;

a rabbet disposed across the front body portion;

a spacer flange disposed above and extending from the front body portion, the spacer flange having a long axis that extends in a direction that is generally perpendicular to the front body portion;

a first chamfer formed at a junction between the top surface and the left body portion;

a second chamber formed at a junction between the top surface and the right body portion;

a third chamfer formed at a junction between the top surface and the rear body portion;

wherein, the plug is sized to occupy a gap formed in the junction between the horizontal member and the vertical mullion of the curtain wall;

wherein, the rabbet, the first chamfer, the second chamfer, and the third chamfer form a plurality of crevices between the plug, the horizontal member, and the vertical mullion; and

wherein the crevices allow penetration of a sealant therein.

2. The plug of claim **1**, wherein the gap is formed in the horizontal member.

3. The plug of claim **2**, wherein the spacer flange engages a cut end of the horizontal member.

4. The plug of claim **1**, wherein the gap is formed in the vertical mullion.

5. The plug of claim **4**, wherein the spacer flange engages a cut end of the vertical mullion.

6. The plug of claim **1**, wherein the top surface is contoured to match a surface contour of at least one of the horizontal member and the vertical mullion.

7. The plug of claim **1**, wherein the top surface is sloped towards the front body portion.

8. The plug of claim **1**, wherein the plug body is rectangular shaped.

9. The plug of claim **1**, wherein the spacer flange is oriented generally orthogonal to the front body portion.

10. The plug of claim **1**, wherein the spacer flange aligns the plug in the gap.

11. The plug of claim **1**, wherein:

the first chamfer is formed at an approximate 45 degree angle relative to the left body portion and the top surface;

the second chamfer is formed at an approximate 45 degree angle relative to the right body portion and the top surface; and

the third chamfer is formed at an approximate 45 degree angle relative to the rear body portion and the top surface.

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